

APPENDIX F - ESTIMATED COST OF MONITORING FOR THE 58 HAP INCLUDED IN IDEM'S PROPOSED AMENDMENTS TO THE STATE EMISSIONS REPORTING RULE

Below are estimated costs of monitoring for the 58 HAP included in IDEM's proposed amendments to the state emissions reporting rule. While some HAP can be monitored using the same methodology (e.g., TO-15), no single instrument or monitoring methodology can measure ambient concentrations of all HAP of concern.

In general the estimated cost for setting up a comprehensive monitoring site (i.e., that can monitor all 58 HAP of concern) would be over \$300,000 with annual operation and maintenance costs estimated at over \$120,000 per site. **Note – Some cost estimates are over three years old, so costs may actually be higher today.**

Identification of compounds included in the HAP's reporting rules according to chemical class suggested EPA reference method for analysis, and instrumentation used for the analysis.

Table 1 provides a summary of the analysis methods for each HAP of concern.

TABLE 1 - SUMMARY OF THE ANALYSIS METHODS FOR EACH HAP OF CONCERN
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COMPOUND	CHEMICAL CLASS	EPA METHOD	COMMENTS
Acetaldehyde	Carbonyl	TO-11	Using DNPH cartridges for trapping carbonyl compounds followed by HPLC analysis using EPA method TO-11 & TO-11A
Acrolein	Carbonyl	TO-11	See above
Acetonitrile	VOC	TO-15	Twenty four hour collection of ambient sample in SUMA polished stainless steel canister followed by an GC or GC/MS analysis
Arsenic compounds	Metal	40 CFR ,part 50, Appendix G	Collection of TSP matter on a hi-volume filters followed by an extraction and analysis by AA or ICP
Benzene	VOC	TO14, TO-15	Same as above
Beryllium compounds	Metal	40 CFR ,part 50, Appendix G	Same as above
1,3-Butadiene	VOC	TO-14 or TO-15	Same as above
Cadmium compounds	Metal	40 CFR ,part 50, Appendix G	Same as above
Carbon Tetrachloride	VOC	TO-14, or TO-15	Same as above
Chloroform	VOC	TO-14 or TO-15	Same as above
Chromium Compounds	Metal	40 CFR ,part 50, Appendix G	Same as above
Coke Oven Emissions	VOC, HAP's, Metal	Group of methods	Each species requires a separate method for sample collection and analysis. For most of these compounds reference method is designated by EPA

1,3 Dichloropropene	VOC	TO-14, TO-15	Same as above
Ethylene dibromide	VOC	TO-14, TO-15	Same as above
Ethylene dichloride	VOC	TO-14, TO-15	Same as above
Ethylene Oxide	VOC	TO-15	Same as above
Formaldehyde	Carbonyl	TO-11A	Same as above
Hexachlorobenzene			
Hydrazine			
Lead Compounds	Metal	40 CFR ,part 50, Appendix G	Same as above
Manganese compounds	Metal	40 CFR ,part 50, Appendix G	Same as above
Mercury Compounds	Metal	NIOSH	Method is listed on Mercury Deposition network site
Methylene Chloride	VOC	TO-14, TO-15	Same as above
Nickel Compounds	Metal	40 CFR ,part 50, Appendix G	Same as above
Perchloroethylene	VOC	TO-14, TO-15	Same as above
Polychlorinated Biphenyls; PCB	PCB	TO-10A; PUF method	
Polycyclic organic matter	PAH	TO-13A; PUF method	Samples are collected using polyurethane foam (PUF) followed by an extraction and analysis
1,2 Dichloropropane	VOC	TO-14, TO-15	Same as above
Quinoline	PAH	TO-10A	Same as above
2,3,7,8-Tetrachlorodibenzo-p-dioxin	Polychlorinated dibenzo-p-dioxins	TO-9A PUF	Same as above
1,1,2,2-Tetrachloroethane	VOC	TO-14,TO-15	Same as above
Trichloroethylene	VOC	TO-14,TO-15	Same as above
Vinyl Chloride	VOC	TO-14,TO-15	Same as above
Chlorine	Corrosive gas	NIOSH	Check the reference book of NIOSH methods
Hydrochloric acid	Acid	NIOSH	Same as above
Hydrofluoric acid	Acid	NIOSH	Same as above
Phosphine			
Methyl Chloroform	VOC	TO-14, TO-15	Same as above
Cobalt	Metal	40 CFR ,part 50, Appendix G	Same as above
Propylene oxide	VOC	TO-15	Same as above
Napthalene	PAH	TO-13A;PUF	Same as above
Methylene (B) 4-phenylisocyanate			
Glycol Ethers	Poly – substituted alcohols	NIOSH	Same as above
Toluene	VOC	TO-14, TO-15	Same as above
Toluene Diisocyanate			
Carbonyl Sulfide	VOC	TO-15	Same as above
Triethylamine	VOC	TO-15	Same as before
Diethanolamine	VOC	TO-15	Same as before
Xylene (O,M,P)	VOC	TO-14, TO-15	Same as before

Hexane	VOC	TO-14, TO-15	Same as before
Methyl ethyl ketone	VOC	TO-15	Same as before
Methanol	VOC	GC Method	
Phenol	VOC	TO-15	Same as before
Styrene	VOC	TO-14, TO-15	Same as before
Vinylidene Chloride	VOC	TO-14, TO-15	Same as before
Chloromethane	VOC	TO-14, TO-15	Same as before

COST ANALYSIS

The cost analysis is estimated based on individual method. The cost is directly related to complexity, labor, instrumentation used for the analysis, QA/QC and reporting requirements of the project. The cost is estimated using the best judgment; the actual cost may be higher.

EPA Method TO-11:

EPA method TO-11 is used for analyzing carbonyl compounds in the air. The monitoring for this compounds requires automatic sampler which collects samples at pre-set times using DNPH cartridges.

After the sampling, the cartridges are extracted with acetonitrile and analyzed on HPLC for various carbonyl compounds. Each sampling cartridges cost about \$20 and analysis cost is about \$110 per sample. Samples are analyzed for formaldehyde, acetaldehyde, acetone, benzaldehyde, crotonaldehyde ETC. The cost of the multi channel sampler is about \$ 12,000.

EPA Method-TO-14:

EPA method TO-14 is used for the VOC analysis. Ambient air sample is collected in a SUMMA polished stainless steel canister for the analysis. The cost of the automatic sampler plus shelter and a canister is about \$12,000 per site. The analysis cost ranges from \$250 to \$300 per canister sample if the laboratory is using a GC/multi-detector system or \$500 to \$600 per sample if the laboratory is using GC/MS (quote from the Eastern Research Group (ERG) contract laboratory).

EPA Method TO-15:

EPA method TO-15 is also used for VOC analysis. The list of compounds has been increased from method TO-14 due to the addition of polar organic compounds. In order to analyze the polar compounds, the method requires the use of GC/MS technology in addition to a special auto-sampling device, which will remove excess moisture from the samples WITHOUT affecting the recovery of the polar organic compounds. The per-sample analysis cost is at least \$600 per canister, and may be higher if analysis of very polar organics, which are unstable in standard mixtures, is desired. The sampler used for method TO-14 can also be used for TO-15 (\$12,000 per sampler)

Metals Sampling and Analysis (40CFR Part 50 Appendix G)

The Code of Federal Regulations method for metals analysis uses glass-fiber filters sampled using a total-suspended-particle (TSP) sampler. These samplers cost approximately \$5,000 to \$6000. The cost of the sample analysis is \$15 per metal analyzed per sample (9 metals analyzed from one sample would cost \$135).

PAH and PCB Analysis (Various methods including TO-9, TO-10, and TO-13; PUF Sampling)

The various PAH analysis methods incorporate a sampler which passes air through treated polyurethane foam (PUF). PAH sampling apparatus cost \$3,000 to \$5,000 per sampler. The cost of the PUF/XAD cartridge is about \$65 per unit. The analysis of PAH samples is very time-consuming and labor intensive. Sample analysis cost for PAH analysis range from \$1000 to \$2,000 per sample depending on number of congeners monitored.

Acid Mist/Acid Gas Analysis (NIOSH Methods for HCl, HF, Cl₂ etc.)

Various NIOSH methods exist for the analysis of acid mists and acid gasses. We do not currently have information regarding the sampling and analysis costs for these methods.

SUMMARY

This summary reflects the cost of monitoring all 58 HAP included in IDEM's proposed amendments to the state emission reporting rule. in the HAP's reporting rule. Each table reflects the cost of monitoring each chemical class for one site at a frequency of one sample every six days. The cost is estimated using any available information and best judgement. Many of these HAP can be monitored using multiple methods and cost would vary accordingly.

Carbonyl Monitoring:

	Unit Cost	Quantity	Total
Sampler	\$12000	1	\$12000
Cartridges	\$20	60	\$1200
Analysis	\$110	60	\$6600
Sub-Total			\$19,800

VOC Monitoring:

	Unit Cost	Quantity	Total
Sampler	\$12000	1	\$12000
Canister Cost	\$500	12	\$6000
Analysis	\$500	60	\$30000
Sub-Total			\$48,000

Metals Monitoring:

	Unit Cost	Quantity	Total
Sampler	\$2500	1	\$2500
TSP Filters			
Analysis (8 metals)	\$250	60	\$15000
Mercury Monitoring	\$200	60	\$12000
Sub-Total			\$29,500

PAH and PCB Monitoring:

	Unit Cost	Quantity	Total
Sampler	\$2000	1	\$2000
Cartridges	\$65	60	\$3900
PAH Analysis	\$350	60	\$21000
PCB Analysis	\$1000	60	\$60000
Sub-Total			\$86,900

Total first year cost per site:

Carbonyl Monitoring:	19,800
VOC Monitoring:	48,000
Metals Monitoring:	29,500
PAH and PCB Monitoring:	<u>86,900</u>
	\$306,200

Total Operation and Maintenance Costs (Using EPA estimates dated 2/1/01): \$122,000